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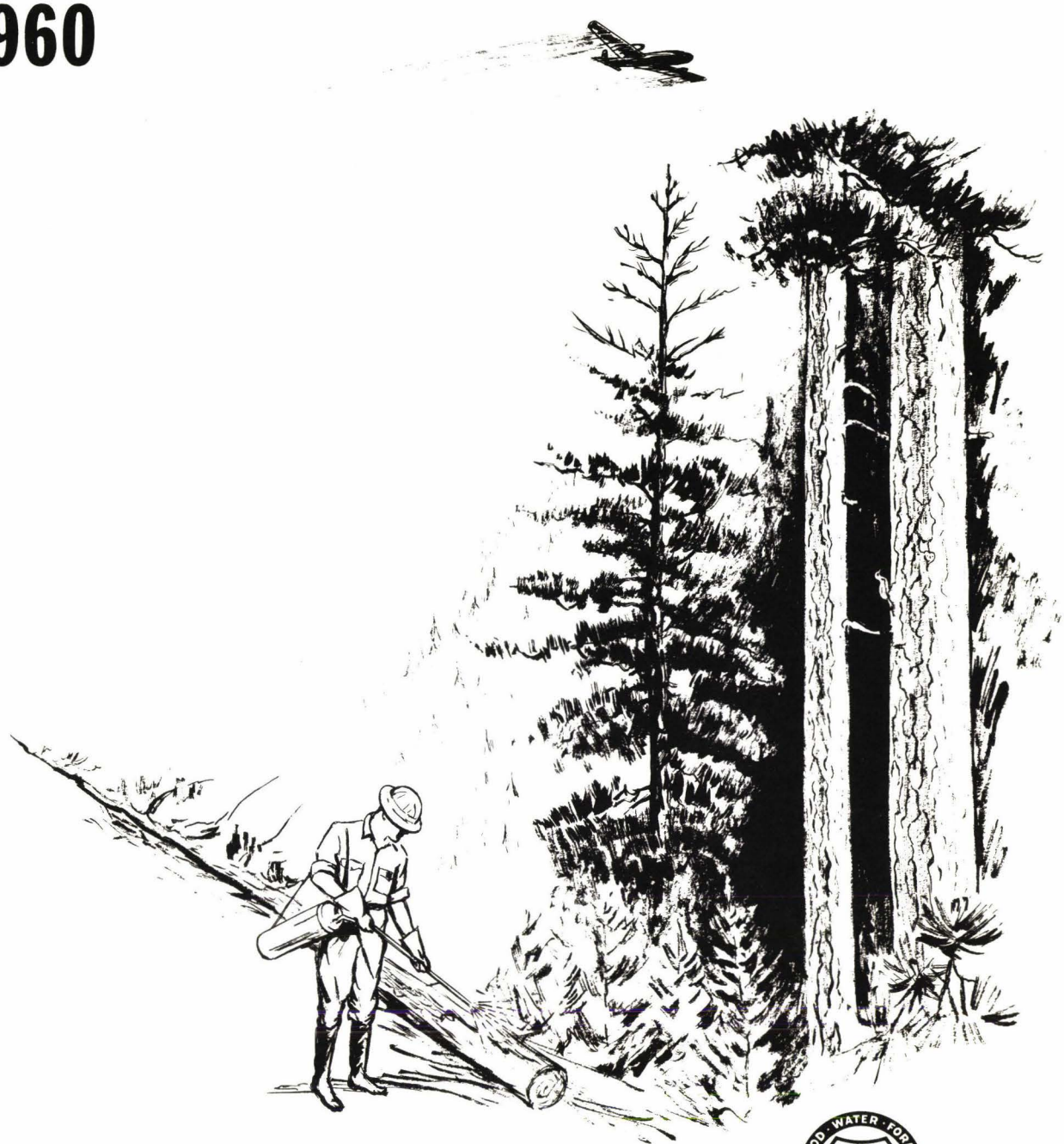
FOREST INSECT CONDITIONS IN THE UNITED STATES 1960



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FOREST INSECT CONDITIONS IN THE UNITED STATES
1960

FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

WASHINGTON, D. C.

JUNE 1961

FOREWORD

The pressing need to more adequately protect the forests of the Nation against destructive insects and diseases prompted the enactment of the Forest Pest Control Act by the Congress in 1947. Among other things, the Pest Control Act authorized the Secretary of Agriculture, directly or in cooperation with other departments of the Federal Government, States, public agencies, and private organizations and individuals, (1) to conduct surveys to detect and appraise outbreaks of forest pests; (2) to determine the kinds of measures that should be taken to suppress them; and (3) to plan, organize, direct and carry out such protective measures as were deemed necessary to prevent undue damage and loss to the forest resources of the Nation.

Shortly after Federal appropriations for Federal leadership and financial aid in insect surveys became available, and as survey programs were developed throughout the country, a start was made to summarize annually the status of the more important forest insects in a countrywide forest insect conditions report. The first summary was for calendar year 1951. That report, and the ones for the two succeeding years, were released as supplements to the Cooperative Economic Insect Report, a publication by the Plant Pest Control Division, Agricultural Research Service, U. S. Department of Agriculture.

Since 1954, the annual summary report on forest insect conditions has been published by the Forest Service, and has also been included as a supplement in the Economic Insect Survey Report. Each year, an effort was made by the Division of Forest Insect Research, Washington, D. C., to compile information on the status of forest insect conditions as concisely as possible and for the interest of diversified readers. In some years, the status of insect conditions was reported on a regional basis. In others, the status of each pest was reported from all sections of the country where it occurred.

This report differs from previous ones in that it includes reports authored by Forest Service entomologists at each of the regional forest and range experiment stations. The highlights on insect conditions for the country as a whole were developed from information contained in the authored reports. An index to insects has been added for the convenience of readers. Comments on the organization, content, format, and style of this report are welcome.

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HIGHLIGHTS

Several species of insects were especially destructive to the forest resource during 1960. Many others caused lesser amounts of damage and loss to forest stands and plantations. As a group, bark beetles were the most important pests and several large-scale outbreaks occurred in the Western and Southern States. Defoliating insects also were important in many sections of the country, particularly in the Central States, the South, Southeast, and along the Atlantic coast. Sawflies were abundant in many pine plantations in the eastern half of the Nation and several outbreaks occurred in forest stands in the East, South, and West. Miscellaneous pests, including weevils, aphids, scales, shoot and tip moths, needle miners, spittlebugs, and many others, were troublesome in local areas countrywide.

Other insect infestations and conditions of regional significance are as follows: The European pine shoot moth was discovered in several additional communities in Washington and in Portland, Oreg.; the program of importing insect predators to control the balsam woolly aphid in the Northeast, the Pacific Northwest, and North Carolina was continued; the larch casebearer continued its spread in northern Idaho and eastern Washington; and the red pine scale was discovered for the first time in New Jersey.

Bark Beetles

The mountain pine beetle was the most important bark beetle in 1960 and epidemics of varying magnitude occurred in several of the Western States. Stands of lodgepole pine in Utah and Idaho were particularly hard hit. Old-growth stands of western white pine in north Idaho were severely attacked, and centers of infestations developed or continued in second-growth stands of ponderosa pine in parts of Oregon, California, Nevada, and Idaho. Suppression of mountain pine beetle infestations was undertaken in most outbreak areas. The largest project, on the Ashley National Forest, Utah, involved felling and spraying 166,808 infested trees. The Ashley project and others in the Western States resulted in treating 185,576 trees at a cost of $849,867.

The Engelmann spruce beetle also was especially destructive during 1960. Outbreaks of most significance were in the high elevation stands of Engelmann spruce in Idaho, Montana, Wyoming, Utah, Colorado, and New Mexico. In the latter two States, all the outbreaks were close to cutting areas or in places where green trees had been blown down by strong winds. The most serious of the infestations occurred on the Uinta, Ashley, and Wasatch National Forests, Utah. Others of nearly equal importance were on the national forests in southern Colorado and northern New Mexico. Infestations were suppressed in most outbreak areas by spraying infested trees, cull logs, and stumps with toxic chemicals. In some areas, green trees were felled to trap attacking beetles. To the extent feasible, trap trees were later logged and, wherever possible, infested trees also were salvaged. Suppression in all outbreak areas involved the treatment of 56,111 infested trees, stumps, and windfalls at a total cost of $237,156.

The black turpentine beetle was the primary insect in the Southern and Southeastern States. There were no major outbreaks, but tree-killing in moderate amounts was widespread, and aggregate losses thus were severe. Exceptionally large acreages of pine stands were affected in Louisiana and Mississippi. Smaller acreages were infested in east Texas, Alabama, Arkansas, and North and South Carolina. Suppression of infestations was undertaken by spraying infested trees and stumps with toxic oils, or by salvage. In all, 548,810 trees and stumps were sprayed at a cost of $146,425. No estimate is available of how many thousand trees were salvaged.

The southern pine beetle continued to pose a serious threat to the extensive stands of southern pines in east Texas, Alabama, and other Southern and Southeastern States. Group-killing of trees was widespread in east Texas during the early summer. The threat of heavier loss and spread of infestation was averted, temporarily at least, by prompt suppression in all accessible areas. A total of 134,299 infested trees in outbreak areas were sprayed at a cost of $119,758. Thousands of additional infested trees were salvaged.

The western pine beetle and the Black Hills beetle were troublesome within their ranges in the Western States. In California, the western pine beetle occurred in outbreak numbers in stands of ponderosa pine adjacent to large burns, and in areas of deficient precipitation in the Sierra Nevada Mountains below 5,000 feet elevation. In the latter area, ips beetles often had killed the tops of trees preceding attack by the western pine beetle. The threat of outbreaks to intensify and spread prompted major efforts to suppress beetle populations in all areas. During the year, a total of 141,729 infested trees were treated in 10 of the Western States at a cost of $368,528. Many thousands of additional trees were salvaged.

Defoliators

The spruce budworm epidemics, a plague in the mixed conifer forests across the Nation, continued unabated in most areas. Infestations in Minnesota increased in intensity and spread southward. Those in Montana, on a gross acreage of some 3,500,000 acres, were little changed from prior years even though a reduction in severity of defoliation, and in moth populations, occurred in some places. In Colorado and New Mexico, outbreaks were the most extensive on record. Infestations in Oregon declined. Aerial spraying was undertaken to suppress populations in areas where tree-killing was imminent. Locations and acreages sprayed are as follows: Maine, 217,000; Minnesota, 24,332; Montana, 117,845; Colorado, 500. Costs of aerial spraying on the 359,677 acres averaged $1.08 per acre.

The most extensive sawfly infestations during the year occurred in stands of Virginia and pitch pine in Maryland and Virginia, and in stands of southern pines in North Carolina, Georgia, and Florida. Other infestations of significance developed in southern pine forests in Louisiana and east Texas, in stands of white pine in Ohio, in lodgepole pines in Montana and Utah, and in red and jack pine plantations in lower Michigan. Suppression of sawfly infestations was quite limited. Virus sprays were used to control the European pine sawfly at scattered locations in Ohio, and DDT was used on the red-headed pine sawfly in Michigan and Wisconsin. The largest suppression projects were in Michigan and Louisiana where 3,000 or more acres were sprayed by aircraft and ground equipment.

Defoliation of hardwoods by the elm spanworm was severe over large acreages in Georgia, Tennessee, and North Carolina. The infestation, encompassing a gross area of 1,670,000 acres, is the first reported outbreak of these dimensions in the Southeast since 1878.

CONDITIONS OF FOREST INSECTS IN FOREST REGIONS

ALASKA

by

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Conditions in Brief

Forest insects in Alaska were less destructive than in some prior years. The threat posed to the hemlock-spruce forests in southeast Alaska by the black-headed budworm and hemlock sawfly was reduced as the insect populations declined. The 1959 downward trend of spearmarked black moth infestations in Interior Alaska continued. The Alaska spruce beetle epidemic of 1958-59 persisted, however, and several new outbreak centers developed. A cedar bark beetle caused heavy tree loss in scrub cedar stands in the central part of the Alaska panhandle.

Status of Insects

ALASKA SPRUCE BEETLE, *Dendroctonus borealis* Hopk. The Alaska spruce beetle continued to cause epidemic losses of white spruce and Lutz spruce on the Kenai National Moose Range in southeast Alaska and on several drainages of the adjacent Chugach National Forest. This infestation has persisted for several years and may have reached its peak in 1960. However, high losses are expected to continue in 1961.

Two new outbreaks of the Alaska spruce beetle also occurred in stands of white spruce near Copper Center; one along the Little Tonsina River, and the other on the east side of the Copper River. Several thousand trees were killed and it is likely that considerably more tree loss will occur before the outbreaks subside.

BLACK-HEADED BUDWORM, *Acleris variana* (Fern.), and HEMLOCK SAWFLY, *Neodiprion tsugae* Midd. Populations of these defoliators declined sharply in the hemlock-spruce stands of southeast Alaska late in the larval feeding period in 1960.

The black-headed budworm built up to fairly high population levels in 1959. This trend continued throughout early 1960 but was reversed later in the year. The factors responsible for the decline are not fully understood, although adverse weather conditions are believed to have played an important role. Insect disease is known to have been negligible, and insect parasitism was but a minor contributing factor. Sampling of the overwintering 1960-61 egg stage showed a reduction of 85-90 percent when compared to similar sampling the previous year.

Hemlock sawfly populations, as revealed by egg counts for the 1959-60 generation, were sporadic. Eggs were absent from most collections but were fairly abundant in most of those in which they did occur.

CEDAR BARK BEETLE, *Phloeosinus squamosus* Blkm. A cedar bark beetle was responsible for the death of large numbers of Alaska-cedar and western redcedar on Kuiu and Kupreanof Islands in the central part of the Alaska panhandle. The outbreak, which extends over several thousand acres, is primarily confined to the scrub cedar stands that occupy the poorly drained slopes and muskeg bottom lands. Heavy tree loss is expected to continue in 1961.

OREGON AND WASHINGTON

by

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Portland, Oregon

Conditions in Brief

Total acreage of insect outbreaks in Oregon and Washington declined for the third successive year, reaching a 10-year low of $1\frac{1}{4}$ million acres.

Native insects presented no acute problems. The spruce budworm continued to subside. A variety of defoliators occurred in outbreak numbers, but none required suppressive action. Damage by the balsam woolly aphid decreased, except in subalpine fir in the Oregon Cascades where renewed tree-killing occurred. Damage by bark beetles was variable by species, but was generally low.

The European pine shoot moth, discovered in Seattle in 1959, was found on ornamentals in several additional communities in Washington and in Portland, Oregon. Efforts to keep this insect from becoming established in native ponderosa pines were accelerated.

Timely salvage of fire-killed trees prevented development of serious outbreaks of bark beetles within or adjacent to the large 1959 burns.

Chemical control was limited to three small projects--two against the mountain pine beetle in lodgepole pine, one against the same insect in immature ponderosa pine.

The program of importing insect predators to control the balsam woolly aphid was continued for the fourth successive year, but on a reduced scale.

Status of Insects

EUROPEAN PINE SHOOT MOTH, *Rhyacionia buoliana* (Schiff.). An intensive cooperative survey of ornamental and forest nurseries, sales yards, and ornamental plantings, prompted by discovery of this insect in 1959 in western Washington, revealed one infestation in Portland, Oreg., two in Spokane, Wash., and many in Seattle, Wash., and vicinity. The discovery in Portland was the first record of infestation in Oregon. Mugho and Scotch pines were most prevalently attacked of the 15 species and varieties found to be infested in the two States. Steps were taken by the States to establish quarantines. The infested trees in Portland were destroyed. Plans for eradication in Spokane were developed, and tests of fumigation as a possible eradication measure were begun.

SPRUCE BUDWORM, *Choristoneura fumiferana* (Clem.). Spruce budworm infestations in the Blue Mountains region of Oregon declined sharply in extent and intensity. On the Fremont National Forest in southern Oregon, and on the Yakima Indian Reservation and adjoining private lands of the Glenwood District in southern Washington, the infestation approximately doubled in extent, but the intensity remained generally low. Trends were essentially as predicted from the 1959 egg survey. No spraying was done. The 1960 egg mass survey indicated that the downward trend in the Blue Mountains region will continue, that infestation on the Fremont will decline over most of the area, and that on the Glenwood-Yakima area the trend will remain static to slightly upward. On this basis, no spraying is planned for 1961.

FIR BUD MOTH, *Zeiraphera* sp. Light defoliation of true firs by an undetermined bud moth, tentatively designated *Zeiraphera* sp., occurred on extensive areas along the Cascade Mountains in Washington. This is the first such outbreak on record. As the buds were not injured, the defoliation to date is not considered serious.

PONDEROSA PINE NEEDLE MINER, *Argyresthia* sp. The outbreak of this as yet unidentified needle miner that developed on ponderosa pine on the Warner District of the Fremont National Forest, Oreg., during 1958 increased markedly in extent and severity. While no tree-killing is in prospect, continued infestation may weaken the

trees to a point where they will be susceptible to bark beetle attack. No control measures have been developed for this insect; as yet none have been needed.

A LARCH SAWFLY. Stands of western larch in four small centers in northeastern Washington were lightly defoliated by an undetermined sawfly. The largest center was on Mt. Spokane. Total area of infestation was 5,440 acres.

LARCH BUD MOTH, *Zeiraphera griseana* (Hubner). Two small centers are all that remain of an extensive outbreak of the larch bud moth which occurred in stands of western larch in the Cascade Mountains of Washington in 1958. As usual with this insect, the outbreak caused no material damage to host trees.

WESTERN OAK LOOPER, *Lambdina fiscellaria somniaria* Hulst. Oregon white oak on approximately 2,080 acres west of Monmouth, Oreg., was almost completely defoliated during early summer. Subsequently the attacked trees refoliated in considerable part. Experience with past outbreaks of this insect has been that they last only a short time and cause no lasting damage.

LARCH CASEBEARER *Coleophora laricella* Hbn. The larch casebearer caused light defoliation of western larch on about 1,920 acres on Mica Peak in northeast Washington.

BLACK-HEADED BUDWORM, *Acleris variana* (Fern.). A light epidemic infestation of the black-headed budworm, which developed jointly in 1959 with the spruce budworm on the Yakima Indian Reservation, Wash., subsided. A small outbreak of light intensity developed in fir-hemlock stands on the Mt. Hood National Forest, Oreg. Little or no damage was caused to host trees.

BALSAM WOOLLY APHID, *Chermes piceae* (Ratz.). Damage by the balsam woolly aphid in Pacific silver fir stands continued to decline. Tree-killing, especially in Washington, reached the lowest level recorded since the infestation flared up in 1954. Stands in many areas have staged remarkable recovery. In subalpine fir, however, aphid populations were high and tree mortality increased, particularly on the south half of the Willamette National Forest, Oreg. Discovery of an aggressive infestation on this host species on the Little River Ranger District of the Umpqua National

Recent invasion of ornamental plantings in Oregon and Washington by the European pine shoot moth creates a serious threat to the pine forests. Surveys are in progress to determine whether eradication is practical.

Spraying for control of the spruce budworm in southern Oregon was averted in 1960 by natural control such as that provided by this parasite.

Forest, Oreg., extended the southern boundary of known infestation in the region. During the past 4 years efforts have been made to effect biological control by colonizing foreign insect predators of the aphid. To date, four species appear to be established; their ability to reduce populations significantly will not be known for several years.

PINE NEEDLE SCALE, *Phenacaspis pinifoliae* (Fitch). During the past several years this scale has weakened and killed ponderosa pine in a number of places in Oregon and Washington, principally in stands adjacent to orchards. The principal infestations in 1960 were near Hood River and The Dalles, Oreg., and in the lower Wenatchee Valley and lower Klickitat River drainage in Washington. The buildup of these infestations is attributed to the reduction in predators and parasites caused by spray drift from the orchards, although this has not been proved.

SPRUCE APHID, *Aphis abietina* Wlk. A light to moderate outbreak on Sitka spruce on the Oregon coast in 1959 subsided to normalcy in 1960.

MOUNTAIN PINE BEETLE, *Dendroctonus monticolae* Hopk. In western white pine, mountain pine beetle infestations in Washington decreased on the Mt. Baker National Forest, remained static on the Olympic Peninsula, and increased sharply on the Snoqualmie and Gifford Pinchot National Forests. The largest and most aggressive centers of epidemic were on the Gifford Pinchot. Infestation decreased in the Oregon Cascades.

In lodgepole pine, infestations increased moderately in Oregon and declined somewhat in Washington. The largest and most aggressive centers of epidemic were on the Fremont National Forest, Oreg. The infestation in Crater Lake National Park, Oreg., continued to be troublesome.

In ponderosa pine, infestations in stagnated pole-sized stands continued to increase. The majority of the centers were on the Fremont and Wallowa-Whitman National Forests, Oreg.

In sugar pine, epidemic infestation was confined to small areas on the Rogue River National Forest, Oreg. Successful control of blister rust in white pine opens the way for reconsidering the need for control of the mountain pine beetle in this tree.

Maintenance control was carried out on an expanded scale in lodgepole pine in Crater Lake National Park, Oreg., where increased losses necessitated recleaning previously treated areas to suppress an epidemic. A pilot control project was carried out on the Fremont National Forest, Oreg., in stagnated ponderosa pine pole stands. This was a stopgap measure until the stands could be thinned to relieve stand pressure which is believed to be the underlying cause attracting the beetle.

DOUGLAS-FIR BEETLE, *Dendroctonus pseudotsugae* Hopk. The widespread epidemic of Douglas-fir beetle that caused heavy losses in stands of Douglas-fir on and near the Siskiyou, Rogue River, Umpqua, and Siuslaw National Forests in southern Oregon during the past 3 years has subsided except for a small outbreak center near the Oregon Caves National Monument. In Washington, infestations on the Colville Indian Reservation and Okanogan National Forest continued upward. The large infestation center near Lost Lake on the Okanogan was especially aggressive. Scattered beetle activity developed in fringe stands along the north side of the Umatilla National Forest in Oregon and Washington.

High velocity winds in November 1958 produced extensive areas of blowdown Douglas-fir in southwestern Washington. Much of this favorable host material was attacked by the Douglas-fir beetle. The trees not removed by logging prior to beetle flight in the spring of 1960 produced broods which attacked standing green trees. The amount of killing is not known with certainty because infested trees could not be seen at the time of the survey; however, the amount certainly was less than had been expected.

Extensive salvage operations in southern Washington removed much of the infested down timber that might otherwise have caused a beetle outbreak.

WESTERN PINE BEETLE, *Dendroctonus brevicomis* Lec. Epidemic conditions of western pine beetle lessened on most areas in Washington. The decline was especially pronounced on the Gifford Pinchot and the Yakima Indian Reservation where heavy losses occurred in 1959. In Oregon, infestation continued upward on most areas. The increase was most noticeable on the Fremont, Malheur, and Ochoco National Forests.

Foreign insect predators are being released for control of the balsam woolly aphid.

In recent years the mountain pine beetle has become an important enemy of young ponderosa pine.

The western pine beetle did not become seriously epidemic around the large burns of 1959. Prompt salvage of scorched trees of merchantable size that were unlikely to survive reduced the potential threat. As a result, epidemics did not develop within the burns or adjacent green timber. No direct control was done.

OREGON PINE IPS, *Ips oregonis* (Eichh.). The number of outbreaks of Oregon pine ips increased, but the total infested acreage declined substantially from prior years. The Malheur and Wallowa-Whitman National Forests in Oregon suffered the bulk of the loss. This ips attacked a high percentage of the badly scorched immature trees within the 1959 burns, but the infestation did not spread to the adjacent green stand. There were no control projects.

FIR ENGRAVER, *Scolytus ventralis* Lec. Tree-killing by this insect in scattered places in Oregon and Washington increased moderately. However, the damage was relatively unimportant as most of the loss was in defective overmature grand fir and in subalpine fir stands of low value.

ENGELMANN SPRUCE BEETLE, *Dendroctonus engelmanni* Hopk. The number of centers of Engelmann spruce beetle infestations in Oregon and Washington increased considerably, but the total infested acreage declined somewhat from prior years. Most of the infestations were in stands scattered along stream bottoms. The largest and most aggressive centers were on the Wenatchee National Forest, Wash. No direct control is needed because most infestations are in small isolated stands, many of which are in remote areas where there is little danger of the infestation spreading.

SILVER FIR BEETLES, *Pseudohylesinus* spp. The infestations of silver fir beetles which had been building up slowly for several years on and near the Mount Baker National Forest, Wash., declined abruptly to a low level. Reasons for the decline in populations are not known.

CALIFORNIA

by

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Conditions in Brief

Forest insects in California were somewhat less destructive in 1960 than in 1959. Pine bark beetle infestations did not become as critical statewide as had been indicated by the trend of developments in 1959. This was due to steps taken early in 1960 to suppress major infestations and by prompt logging of fire-injured trees damaged by the holocausts of 1959. Another factor that may have deterred or delayed beetle development was unusually cold, wet weather in the late spring months.

Despite these favorable developments, destructive infestations of certain pine bark beetles, the California flatheaded borer, the lodgepole needle miner, and several other well-known pests persisted. Other problems helped to complicate the situation. These included a resurgence of fir engraver infestations, discovery of an outbreak of the large aspen tortrix, and the threatened spread of the European pine shoot moth into California. Last but not least was the tremendous increase in potential bark beetle infestations resulting from another year of extensive forest fires. Bark beetle outbreaks around most 1959 burns were relatively minor. The second year after a fire is often critical, however; consequently these areas as well as the ones burned in 1960 remain as a hazard.

Status of Insects

WESTERN PINE BEETLE, *Dendroctonus brevicomis* Lec. The western pine beetle, perennially one of California's most destructive forest insects, continued to do damage, but the magnitude of infestations was variable. Early spring control efforts reduced certain infestations; some subsided naturally; others remained much the same as they were in 1959. In northeastern California, outbreaks were centered in ponderosa pine stands in portions of Modoc and Lassen

Ponderosa pine killed by western pine beetle and ips as an aftermath of the Hellhouse fire, Tehama County, California.

Knobcone pine killed by ips beetles on the Lava Burn, Modoc County, California.

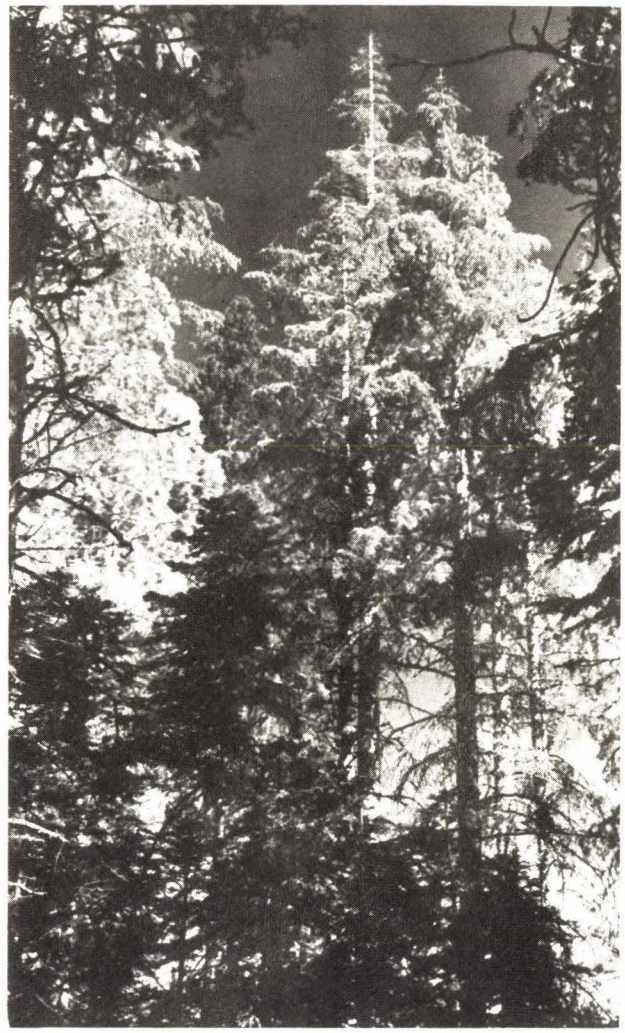
Counties. A flareup of activity, complicated by ips, occurred in Tehama County. Farther south, heavy infestations persisted throughout the lower elevation ponderosa pine belt, from Mariposa County south to Tulare County. In the ponderosa and Coulter pine stands of southern California, outbreaks occurred in the Lost Valley, Julian, Palomar Mountain, Agua Tibia, and May Valley areas.

MOUNTAIN PINE BEETLE, *Dendroctonus monticolae* Hopk. In sugar pine, the mountain pine beetle was much less destructive in 1960; no unusual activity was reported. In ponderosa and lodgepole pine, infestations were much the same as in 1959. Stands of these two species in the Warner Mountains, however, continued to sustain heavy infestations. The severe outbreaks in Modoc County in pole-sized ponderosa pine and in lodgepole pine showed no signs of abating. Other infestations in lodgepole pine occurred in Lassen and Plumas Counties and in the Dingley and Delaney Creek drainages north of Tuolumne Meadows, Yosemite National Park.

JEFFREY PINE BEETLE, *Dendroctonus jeffreyi* Hopk. Relatively little damage from the Jeffrey pine beetle was reported. Slight increases in infestations were noted in the Jeffrey pine stands of eastern Plumas County, and around Blacks Mountain and along the northern boundary of Lassen Volcanic National Park in western Lassen County. None of these infestations reached outbreak proportions.

IPS (PINE ENGRAVERS), *Ips* spp. These beetles were associated to varying degrees with most of the western pine beetle outbreaks in northern and central California. In several areas ips beetles were also aggressive in their own right. Several infestations showed up in knobcone pine; two near McCloud, the others in the northern part of the State. Severe infestations in ponderosa pine flared up in Amador County, and a moderate amount of damage to ponderosa pine was reported in Mariposa and Madera Counties. In southern California, knobcone pine and Coulter pine in several localities were hard hit.

FIR ENGRAVER, *Scolytus ventralis* Lec. The fir engraver was much more abundant than usual and losses caused by it increased



Fir engraver outbreaks killed many groups of white fir throughout northeastern California.

generally throughout the range of white fir and red fir. Losses due to this beetle are not expected to remain for long at a high level. Outbreaks are usually short lived because natural factors combine to reduce epidemic populations.

DOUGLAS-FIR BEETLE, *Dendroctonus pseudotsugae* Hopk. No significant outbreaks of the Douglas-fir beetle occurred in 1960. A potential buildup of this pest in fire-damaged timber in Mendocino County was averted by logging the infested trees.

DOUGLAS-FIR ENGRAVER, *Scolytus unispinosus* Lec. This insect, which was responsible for considerable mortality in young-growth Douglas-fir in Humboldt and Mendocino

Counties during 1959, caused negligible damage in 1960. Violent fluctuations in abundance seem to be characteristic of this bark beetle, and the behavior of this outbreak was much as expected.

CALIFORNIA FLATHEADED BORER, *Melanophila californica* Van D. The California flatheaded borer continued to be an important factor contributing to the death of pines in various parts of the State. Some of the heaviest damage was in Jeffrey pine stands of southern California.

LODGEPOLE NEEDLE MINER, *Evagora milleri* (Busck). This needle miner continued in outbreak in the lodgepole pine forests of the southern Sierra. The most serious infestation was one that has been in progress for more than a decade in the Tuolumne River drainage, Yosemite National Park. Upwards of 60,000 acres remain infested in the park, and tree-killing due to the needle miner alone, and to it in combination with the mountain pine beetle, has been severe. Additional spraying, an extension of the control work done in 1959, is planned for a portion of this outbreak in 1961.

At Sentinel Meadows, Mono County, a needle miner closely related to *Evagora milleri* continued to defoliate lodgepole pine. Populations were very heavy, and the trend of this infestation seemed to be upward. Tree mortality, however, has been negligible.

SPRUCE BUDWORM, *Choristoneura fumiferana* (Clem.). California's only known spruce budworm infestation, which has been active but relatively innocuous for many years in white fir stands of the Warner Mountains, increased both in area and intensity in 1960. Top-killing was observed for the first time in heavily defoliated young trees. Signs of budworm damage also were detected in the Rush Creek drainage, Modoc County, some 25 miles west of the insect's previously known range. The actual presence of the budworm here was not confirmed, however.

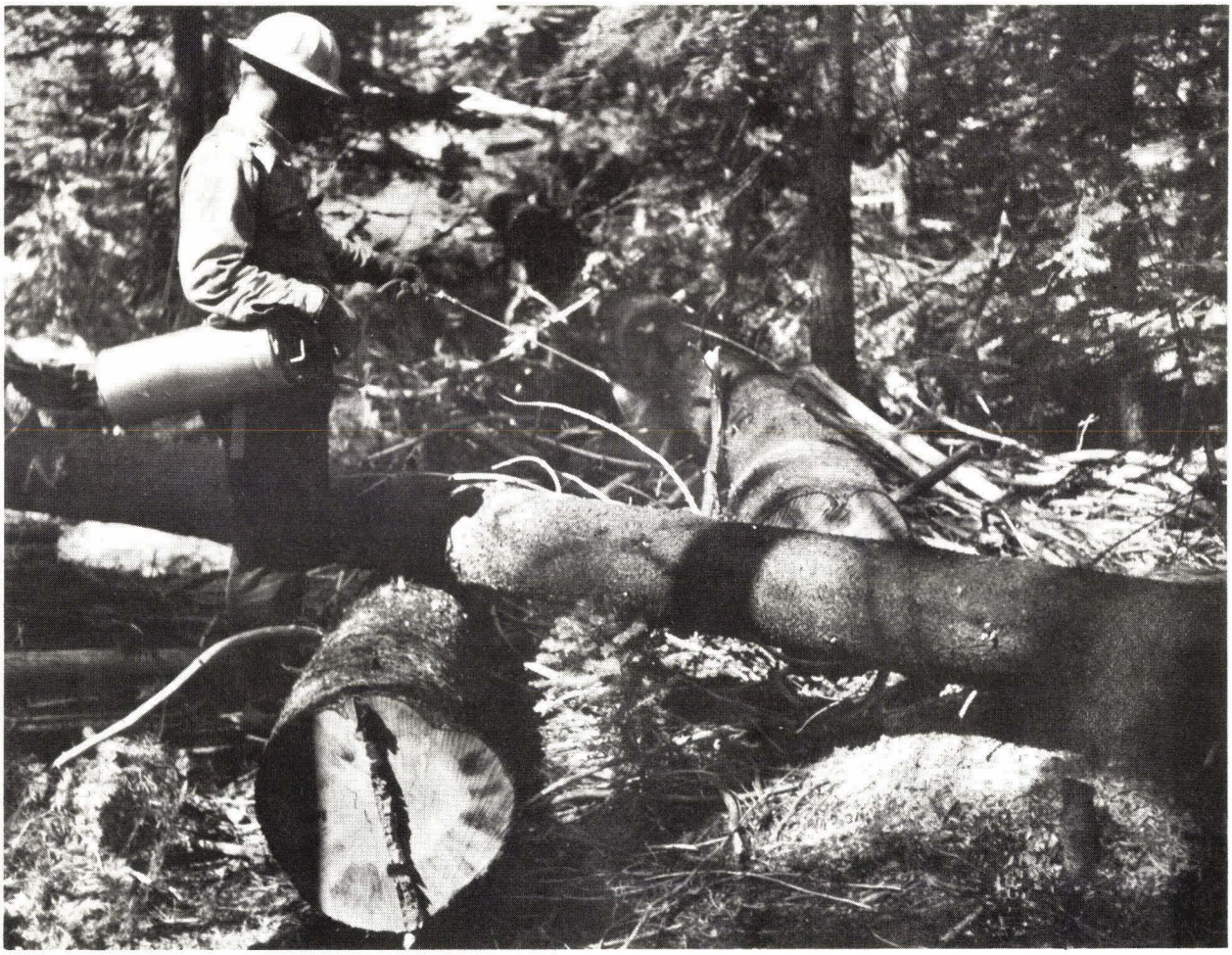
OTHER INSECTS. Among the many indigenous pests that continued to take heavy tolls, particularly of the growth potential, were the lodgepole terminal weevil, *Pissodes terminalis* Hopp., on lodgepole pine; various species of *Neodiprion* sawflies on young pine and fir; and the black pine-leaf scale, *Aspidiotus californicus* Colm., on ponderosa and sugar pines. Infestations of the Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD., in white fir remained endemic. The pine reproduction weevil, *Cylindrocopturus eatoni* Buch., did some damage to planted or naturally established seedlings.

Cone and seed insects severely limited seed production in most commercially important tree species. Cone moths (particularly *Dioryctria abietella* D. & S., and to a lesser extent *Barbara colfaxiana* (Kearf.)), and a midge, *Contarinia* sp., caused major damage to the light to moderate crop of Douglas-fir cones. Seed chalcids, *Megastigmus* spp., caused moderate to heavy losses in white fir, and red fir suffered heavily from seed maggots, *Earomyia* spp. The ponderosa pine seed crop was heavy and insect damage, mostly from the ponderosa pine cone beetle, *Conophthorus ponderosae* Hopk., was light. Damage to sugar pine cones was variable and the cone crop spotty, but in some localities the sugar-pine cone beetle, *C. lambertianae* Hopk., killed practically all the cones. In Jeffrey pine, where the cone crop was light to moderate, insects destroyed about a third of the seed.

Of the several new or rarely collected forest insects in California, one of the more important ones found in 1960 was the large aspen tortrix, *Choristoneura conflictana* (Wlkr.). The first recorded outbreak of this pest in California was discovered in aspen stands in Modoc County. The tortrix, a destructive defoliator of aspen in other parts of the country, had been found only once or twice in California previously.

Suppression

Most forest insect control work in California was aimed at reducing bark beetle infestations. Outbreaks were suppressed in many areas by spraying the trees with insecticides or by peeling and burning the bark. In addition, much of the infested timber was logged before the beetles matured. Logging for control accounted for the salvage of over 150 million board feet of timber. The logging of an additional 500 million board feet of fire-killed or windthrown trees, potentially breeding grounds for bark beetles, helped to keep infestations from becoming more destructive.



Lindane sprays were widely used in California to suppress pine bark beetle infestations.

INTERMOUNTAIN AND NORTHERN ROCKY MOUNTAIN STATES

by

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Conditions in Brief

Infestations of several forest insects in the Intermountain and northern Rocky Mountain States were quite severe. The mountain pine beetle was particularly destructive to many lodgepole pine stands in Utah. Large-scale epidemics of Engelmann spruce beetle also occurred in Utah and at several locations in Idaho and western Wyoming. Control campaigns were waged against these beetles in all outbreak areas.

The spruce budworm epidemic persisted in Montana. Populations were lower, however, in southern Utah. The larch casebearer continued its spread in northern Idaho and eastern Washington. Epidemics of the lodgepole needle miner occurred on large areas in Idaho and Wyoming. Tussock moths were abundant in Utah and Nevada. Direct control was undertaken against the spruce budworm in a part of Montana and virus sprays were used to suppress an outbreak of the tussock moth in Nevada.

Status of Insects

MOUNTAIN PINE BEETLE, *Dendroctonus monticolae* Hopk. The mountain pine beetle has been infesting old-growth white pine stands in the Clearwater National Forest, Idaho, since 1934. During the period 1952 to 1960, tree mortality has averaged about $2\frac{1}{2}$ percent of the stand annually. Localized infestations of the beetle caused depletion of the mature white pine type on the Coeur d'Alene, St. Joe, and Kaniksu National Forests, Idaho, and the Kootenai National Forest, Mont.

Mountain pine beetle activity in lodgepole pines in the northern Rocky Mountain States was at a low level. However, widely scattered, single trees and small groups of trees were infested on about 17,300 acres on the Kootenai National Forest, Mont.

In the Intermountain States, mountain pine beetle infestations continued at a high level in many lodgepole pine stands in northern Utah, eastern Idaho, and western Wyoming. In 1959, 22 infestation centers occurred in lodgepole pine stands of these States. Twenty of these were included in control projects during 1960. Nearly all will need additional control in 1961. On the Teton National Forest and Grand Teton National Park, Wyo., infestations increased. Epidemic centers also developed on the Targhee National Forest and adjacent lands, Idaho.

Control of the mountain pine beetle in lodgepole pine in northern Utah during the past 3 years has been effective in reducing the beetle populations. It has materially reduced the size of infested areas on the Wasatch National Forest where the most serious outbreaks occurred. Control has also been effective in reducing the severity of infestations on the Sawtooth National Forest, Idaho.

Mountain pine beetle infestations have been severe in stands of second-growth ponderosa pine at two locations in the Intermountain States for the past several years. One of these, near Atlanta, Idaho, was reduced to a low level by cutting, decking, and burning the infested trees. The other, at Crystal Bay on the north shore of Lake Tahoe, Nev., persisted.

ENGELMANN SPRUCE BEETLE, *Dendroctonus engelmanni* Hopk. Several serious outbreaks of this insect have developed in the Intermountain and northern Rocky Mountain States during the past few years. All of them have been subjected to control, and infestations in 1960 were less severe than in prior years. With minor exceptions, the outbreaks of long standing in northern Idaho and western Montana have been reduced to endemic levels. Those in southern Idaho and western Wyoming, first reported in 1959, also were brought under control in 1960. The epidemic on the Uinta, Ashley, and Wasatch National Forests, Utah, on an area of about 100 square miles, was first subjected to control in 1958. The suppression campaign was continued in 1959 and

1960 and infestations thus have been reduced to an endemic level. Beetle populations in the upper Green River area on the Bridger National Forest, Wyo., threaten spruce stands in that location.

BLACK HILLS BEETLE, *Dendroctonus ponderosae* Hopk. Populations of Black Hills beetle in ponderosa pine stands of southern Utah have shown a definite downward trend for the past several years. The downward trend continued in 1960.

DOUGLAS-FIR BEETLE, *Dendroctonus pseudotsugae* Hopk. Douglas-fir forests in the northern Rocky Mountains have suffered periodically from outbreaks of Douglas-fir beetle. These have occurred about every 9 years and have been serious for 3 to 4 years. The last major outbreak in Montana and north Idaho occurred during the period 1950 to 1952. The presence of red-topped trees throughout much of the Douglas-fir type in 1960 indicates that another outbreak is developing. Infestations are scattered within areas that total more than 400,000 acres on six national forests and other lands.

The Douglas-fir beetle was abundant throughout south Idaho, western Wyoming, and Utah. Douglas-fir stands on the Sawtooth National Forest, Idaho, and on the Dixie National Forest, Utah, were particularly hard hit. Tree-killing by the Douglas-fir beetle in these areas is expected to continue at about the same level next year.

FIR ENGRAVER, *Scolytus ventralis* Lec., and WESTERN BALSAM BARK BEETLE, *Dryocoetes confusus* Sw. These insects kill many thousands of true firs each year throughout the Intermountain States. The majority of the killed trees grow in rather inaccessible areas and have relatively low economic value. Thus, control of infestations is rarely undertaken. Heavy broods of the fir engraver were found in pole-sized grand fir near St. Maries, and a light infestation occurred in small grand firs near Clarks Fork, Idaho. A small outbreak of *D. confusus* Sw. was reported in subalpine fir trees near Mt. Washburn, Yellowstone National Park, Wyo.

IPS (PINE ENGRAVERS), *Ips* spp. These beetles were not a serious problem in the Intermountain and northern Rocky Mountain States in 1960. However, the Oregon pine ips, *I. oregonis* (Eichh.), did kill the tops of some mature ponderosa pines as well as patches of pine reproduction on about 200 acres of the Custer National Forest, Mont. Infestations also were reported on about 200 acres of pine on the Kootenai National Forest, Mont. A few large groups of pole-size ponderosa pines were killed on private land near Plains, Mont. Some mature ponderosa pines were killed on the Kaniksu National Forest, Idaho, by the emarginate ips, *I. emarginatus* Lec.

WESTERN PINE BEETLE, *Dendroctonus brevicomis* Lec. A few small groups of ponderosa pines infested by the western pine beetle were reported on the Kaniksu National Forest in northern Idaho and on private land in the Thompson Lakes area west of Kalispell, Mont. An estimated 100 trees were attacked and killed west of Rexford, Mont. In the Meadow Creek drainage of the Lolo National Forest, western pine beetle broods were found infesting mature pines. In other areas under observation, beetle populations were at a relatively low level.

SPRUCE BUDWORM, *Choristoneura fumiferana* (Clem.). Infestations of the spruce budworm continued in epidemic status throughout the fir forests in Montana. Defoliation decreased in some small areas but these were an insignificant part of the total area infested. Although the epidemic continued, there was no appreciable increase in infested acreage, which approximated $3\frac{1}{2}$ million acres in 1959. Tree damage from budworm defoliation is expected to continue in 1961 at about the same level as in 1960.

Spruce budworm populations are generally lower in southern Idaho than have been observed during the past several years. They decreased generally in the southern part of the State, except on the Challis and Targhee National Forests. On the Targhee National Forest, an older infestation showed increase. This occurred on an area of approximately 4,000 acres. A new infestation on about 150,000 acres developed on the Challis National Forest. Medium to heavy defoliation was noted on about a third of the area.

TUSSOCK MOTHS, *Orgyia* spp. An infestation by a tussock moth, suspected to be *Orgyia antiqua* (L.), occurred on approximately 50 square miles of brush surrounding the Boise Basin Experimental Forest and Town Creek Plantation, Idaho. A virus reduced the population in Town Creek Plantation

considerably in 1959, but reinfestation occurred from large surrounding infested areas by population movement during the early larval instars. In 1960 there was an increase in number of egg masses of about 4 to 1 over 1959. The greatest increase in defoliation in 1961 is expected to occur within the pine planting areas on the Boise Basin Experimental Forest. The epidemic within the Town Creek Plantation will also probably continue.

An infestation of an unknown species of tussock moth, covering about 5,000 acres of white fir, was discovered on Wheeler Peak, Nev., late in 1959. It was suppressed by virus sprays applied by airplane. Another infestation on white fir on Highland Peak, near Pioche, Nev., presumably the same species found on Wheeler Peak, was discovered early in 1960. Examination of the remains of mature larvae showed that a virus disease had been active in the population. These findings suggest that the infestation may subside rather rapidly.

LARCH CASEBEARER, *Coleophora laricella* (Hbn.). This defoliator has spread over an area of more than 8,000 square miles, including practically all of northern Idaho and parts of eastern Washington, since its discovery at St. Maries, Idaho, in 1957. In 1960 defoliation was severe enough to be visible over an area of 532 square miles in the vicinity of St. Maries and on the adjacent St. Joe National Forest.

Approximately 2,500 adults of the braconid parasite, *Agathis pumilus* (Hymenoptera), were obtained from the Northeastern States and released at 5 locations near St. Maries in June in an effort to promote biological control of the casebearer. Results will not be known for several more years.

PINE SAWFLIES, *Neodiprion* spp. Two species of sawflies, recently determined as *N. fulviceps* complex, and *N. nanulus contortae* Ross, have defoliated overstory lodgepole pine in the Little Rocky Mountains, near Zortman, Mont., since 1958. The severity of the outbreak declined in 1960. Cause of the decline is unknown, but examinations in June showed that 68 percent of the sawfly eggs were nonviable.

An outbreak of the pinyon pine sawfly, *N. edulicolus* Ross, which has been underway in stands of pinyon pine near Pioche, Nev., during the past few years, decreased in 1960. Unseasonal snow storms and low temperatures reduced the population.

LARCH SAWFLY, *Pristiphora erichsonii* (Hartig). The larch sawfly continued active in stands of western larch in the Blackfoot River drainage, northeast of Missoula, Mont. No tree-killing has occurred in the infested area.

TWO-LINED LARCH SAWFLY, *Anoplonyx occidens* Ross. Light defoliation of western larch trees by the western larch sawfly was reported in a local area west of Noxon, Mont. *An unknown sawfly species* which has been defoliating Douglas-fir on a portion of the Sawtooth National Forest, Idaho, and adjacent lands during recent years, and which reached a high level in 1959, was reduced by natural factors in 1960. Defoliation of trees dropped from a high of 90 percent or more to less than 25 percent.

PANDORA MOTH, *Coloradia pandora* Blake. The pandora moth was reported on about 15,000 acres of lodgepole pine in northeastern Utah. The population is heavy, and defoliation, with possible tree mortality, might occur in 1961.

NEEDLE MIDGE, *Contarinia* sp. An outbreak of an unidentified needle midge first appeared on Douglas-fir between Newport, Wash., and Rexford, Mont., in 1950. Infestations of this midge were found again in this area in 1960. Christmas trees ready for harvest were badly damaged in the Lolo and Kootenai National Forests and the Flathead Indian Reservation.

PINE RESIN MIDGE, *Retinodiplosis* sp. An epidemic of a pine resin midge that caused severe damage to lateral branch tips in numerous ponderosa pine plantations over the Northern Rocky Mountain States in 1959 subsided in 1960.

LODGEPOLE NEEDLE MINER, *Evagora milleri* (Busck). Infestations of the lodgepole needle miner have increased in severity in the lodgepole pine forests of the Intermountain States since 1957. Epidemic centers now exist on the Targhee, Sawtooth, and Caribou National Forests, Idaho; and on the Bridger National Forest, Wyo. Infestations in 1960 were epidemic on over 200,000 acres. The largest, on the Targhee National Forest, is in the center of a large commercial stand of lodgepole pine. An infestation was also reported near Zortman, Mont.

PINE TIP MOTH, *Rhyacionia* sp. Infestations of a pine tip moth have persisted for several years in understory ponderosa pine

stands on the Custer National Forest, Mont. and S. Dak., and heavy damage occurred last year. Examinations in 1960 indicated a rather sharp reduction in the infestation.

PINE SHOOT MOTH, *Eucosma* sp. A light infestation of a pine shoot moth on ponderosa pine was reported in the Libby, Mont., area in 1959. There was little evidence of the infestation in 1960.

ASPEN LEAF MINER, *Phyllocnistis populiella* Chamb. Populations of this leaf miner, which have been reported in western Wyoming and eastern Idaho for the past 10 to 13 years, continued to inflict extensive damage to aspen stands in 1960. Tree mortality as a result of defoliation is becoming increasingly evident.

WHITE FIR NEEDLE MINER, *Epinotia meritana* Hein. A serious outbreak of this needle miner in stands of white fir in southern Utah was suppressed in 1957 by aerial application of malathion. Heavy parasitism at that time also helped to reduce the outbreak. In 1960, an increase in population was observed.

SPRUCE MEALYBUG, *Puto* sp. Populations of a spruce mealybug continued at epidemic levels within Engelmann spruce stands in southern Utah. The infestations occur in three separate areas, totaling approximately 60,000 acres. Mortality of Engelmann spruce reproduction is noticeable within the older infestations.

An infestation of another unidentified mealybug which has been reported in true firs on the Payette National Forest for several years continued. Damage to date has not been significant.

WOOLLY PINE APHID, *Pineus* sp. An unidentified woolly aphid has been under suspicion as a factor contributing to a needle blight on western white pine throughout its range in northern Idaho and western Montana since 1958. So far, its relation to the blight is still unknown.

COOLEY SPRUCE GALL APHID, *Chermes cooleyi* Gill. A heavy population of Cooley spruce gall aphid was reported on needles of Douglas-fir east of Seeley Lake, Mont., during 1960. The aphid also was abundant on ornamental spruce trees near Missoula, Montana.

DOUGLAS-FIR BARK MOTH, *Laspeyresia fletcherani* (Kearf.). Damage by larvae of the Douglas-fir bark moth has been increasing for the past few years in Douglas-fir Christmas tree stock growing on the Kootenai National Forest, Mont.

CENTRAL AND SOUTHERN ROCKY MOUNTAINS

by

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Conditions in Brief

Insect outbreaks were numerous in the forested areas of the Central and Southern Rocky Mountains and tree damage and tree-killing were severe in many areas. The Engelmann spruce beetle posed a continuing threat to the high elevation stands of Engelmann spruce in Colorado and New Mexico. Black Hills beetle infestations increased in ponderosa pine in Colorado and in portions of Wyoming. Mountain pine beetle infestations continued or increased in stands of lodgepole and limber pine in Wyoming. Several direct control projects were undertaken to suppress outbreak populations.

Epidemics of the spruce budworm in the spruce-fir forests in Colorado and New Mexico were the most extensive on record. Heavy damage to affected stands is forecast for 1961. The Great Basin tent caterpillar persisted in outbreak numbers in stands of aspen in northern New Mexico. In southern Colorado, however, tent caterpillar populations declined to the lowest level of the past 10 years. The intensity of pandora moth infestations decreased in outbreak areas in southern Wyoming and northern Colorado. No major projects were undertaken to control defoliating insects during the year.

Status of Insects

SPRUCE BUDWORM, *Choristoneura fumiferana* (Clem.). The spruce budworm outbreak in the mixed conifer forests in southern Colorado and northern New Mexico was the most extensive on record. The area of infestation, approximately 1,277,000 acres, was only slightly larger than in 1959 but the severity of defoliation increased markedly. Tree mortality was moderate to heavy in many areas, particularly in understory trees. Severe defoliation and additional tree mortality is expected in 1961.

ENGELMANN SPRUCE BEETLE, *Dendroctonus engelmanni* Hopk. The Engelmann spruce beetle continued to be a serious problem in mature and overmature stands of Engelmann spruce in southern Colorado and northern New Mexico. Outbreaks in local areas were numerous in Colorado and, without exception, were adjacent to cutting areas or in places where green trees had been blown down by strong winds. Nearly 10,000 trees were killed on 7,000 acres in the East Mosea-Cold Creek area on the San Juan National Forest, Colo. In another outbreak on the same forest some 6,000 trees were killed on 3,000 acres.

The outbreak reported last year on the Tierra Amarilla Grant near Chama, N. Mex., increased and tree-killing was severe on approximately 8,000 acres. On the Rio Grande Grant, and on portions of the adjacent Carson National Forest, N. Mex., infestations with a potential of enveloping extensive areas, were reported on 10,000 acres.

BLACK HILLS BEETLE, *Dendroctonus ponderosae* Hopk. Infestations of the Black Hills beetle increased in ponderosa pine along the Front Range of the Rocky Mountains. The greatest increase was reported on the Pike and San Isabel National Forests in Colorado and on the Bighorn National Forest in Wyoming. In some areas there was a sevenfold increase in numbers of trees killed during 1960 as compared to 1959.

Infestations in the Black Hills of South Dakota were less intensive than for the past several years. In northern New Mexico, the rate of tree-killing was moderate and infestations were localized on parts of the Carson National Forest.

MOUNTAIN PINE BEETLE, *Dendroctonus monticolae* Hopk. Several outbreaks of the mountain pine beetle were reported in stands of lodgepole pine and limber pine on portions of the Shoshone National Forest, Wyo. The trend of these infestations was upward in lodgepole pine in the Long Creek and Sheridan Creek drainages but downward elsewhere. In stands of limber pine, the rate

Defoliation of Douglas-fir by spruce budworm, Pike National Forest, Colorado.

Cull logs and other debris left in Engelmann spruce cutting areas provide conditions for the buildup of Engelmann spruce beetle populations and subsequent attack of green trees.

of tree-killing was high only at Pike Miller Park and along Rock Creek.

DOUGLAS-FIR BEETLE, *Dendroctonus pseudotsugae* Hopk. Infestations of the Douglas-fir beetle increased sharply throughout the Douglas-fir stands in Arizona and New Mexico. New outbreaks were reported on the Kaibab, Apache, and Coronado National Forests, and on the Apache Indian Reservation, Ariz. Tree-killing continued at a high level on the Santa Fe National Forest, N. Mex.

In Colorado and Wyoming, most infestations of the Douglas-fir beetle were less severe than for the past few years. While the rate of tree-killing increased in some places it decreased in most of the others.

OREGON PINE IPS, *Ips oregonis* (Eichh.). This insect caused scattered group-killing of ponderosa pine in the northern Black Hills of South Dakota, within and adjacent to areas thinned and cut. Many of the trees that were killed in groups of 5 to 30 were young and vigorous. The area of infestation has suffered from deficient precipitation in recent years.

In New Mexico, the Oregon pine ips often attacked and killed the top section of the trees. Later on, the lower sections of the top-killed trees were attacked by *Dendroctonus barberi* Hopk. and *D. convexifrons* Hopk.

ARIZONA FIVE-SPINED IPS, *Ips lecontei* Sw. The Arizona five-spined ips occurred in outbreak numbers in stands of second-growth ponderosa pine at several locations on the Prescott National Forest, Ariz. Tree-killing was particularly severe in areas set aside for summer homes near Prescott. Groups of 10 or more trees also were killed at many places in timber-producing areas. The total area of infestation is estimated at 10,000 acres.

CALIFORNIA FIVE-SPINED IPS, *Ips confusus* (Lec.). An outbreak of the California five-spined ips developed in stands of pinyon pine adjacent to Walnut Canyon National Monument, Ariz. In this general area, pinyon and juniper trees had been uprooted by tractors to improve lands for grazing by livestock. It is believed the infestations developed in the uprooted pines and later attacked and killed the standing trees.

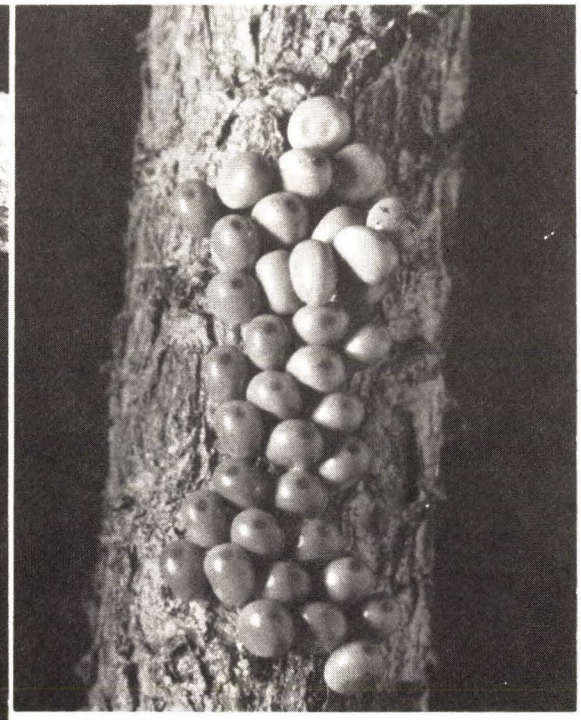
FIR ENGRAVER, *Scolytus ventralis* Lec. The killing of firs by this engraver was widespread in Arizona and Nex Mexico. The 2-year-old outbreak covering 25,000 acres of white fir on the Lincoln National Forest and the Mescalero Indian Reservation, N. Mex., continued active, and many large trees of high value were killed. In the Sandia Mountains, east of Albuquerque,

N. Mex., the trend of infestations is downward. However, tree-killing on some 5,000 acres was severe. Two new infestations, each on about 600 acres of white firs, were reported in 1960. One occurred on the Kaibab National Forest, Ariz.; the other on the Carson National Forest, N. Mex.

WESTERN BALSAM BARK BEETLE, *Dryocoetes confusus* Sw. Large numbers of subalpine firs in southern Colorado and northern New Mexico were attacked and killed by the western balsam bark beetle. In Colorado, tree-killing was most severe on approximately 15,000 acres of the Rio Grande National Forest. In New Mexico, concentrations of loss were most noticeable on 40,000 acres in the Carson National Forest.

DOUGLAS-FIR TUSSOCK MOTH, *Hemerocampa pseudotsugata* McD. A new 3,000-acre infestation of Douglas-fir tussock moth was discovered in stands of white fir in the San Mateo Mountains, N. Mex. This outbreak, and an older one in the Sandia Mountains nearby, were suppressed by aerial application of DDT.

GREAT BASIN TENT CATERPILLAR, *Malacosoma fragile* (Stretch). This defoliator has occurred in outbreak numbers in stands of aspen over large areas in northern New Mexico and southern Colorado for the past decade. Beginning in 1958, and continuing in 1959, caterpillar populations were reduced by natural factors. New infestations were reported on about 100,000 acres in northern New Mexico in 1960 and natural



Pandora moth and cluster of eggs on stem of lodgepole pine, Medicine Bow National Forest, Wyoming.

control was negligible. In southern Colorado, infestations continued on a downward trend.

PANDORA MOTH, *Coloradia pandora* Blake. An infestation of this moth, previously known on some 8,000 acres of lodgepole pine forest along the Colorado-Wyoming border in 1959, decreased in intensity. Adults were numerous on the forest floor in August and some were attracted from the forest to lights in towns more than 100 miles distant from the outbreak center. Eggs were not numerous in the outbreak area after the moth flight and little damage to host trees is expected in 1961.

PINE SAWFLY, *Neodiprion* sp. An unidentified pine sawfly occurred in outbreak proportions on about 1,200 acres of ponderosa pine in the Zuni Mountains, western New Mexico. Damage to host trees was not severe.

LAKE STATES

by

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Conditions in Brief

The forested areas in the Lake States were affected by several important forest insects. The spruce budworm infestation in northern Minnesota expanded in area and increased in intensity. Jack-pine budworm infestations also increased greatly in Minnesota and Michigan and defoliation was particularly heavy there, as well as in parts of Wisconsin.

Sawflies and the white-pine weevil were abundant in pine plantations throughout the Lake States. The European pine shoot moth was destructive to red pine plantings in Lower Michigan. Populations of the forest tent caterpillar declined to the lowest level of the past several years.

Aerial spraying was undertaken to suppress epidemic populations of the spruce budworm in northern Minnesota and to control certain destructive infestations of white-pine weevil and Saratoga spittlebug in Wisconsin, Michigan, and Minnesota.

Status of Insects

SPRUCE BUDWORM, *Choristoneura fumiferana* (Clem.). The spruce budworm outbreak in northern Minnesota, first noted in 1954, continued to expand in area and increase in intensity. Nearly 100,000 acres of spruce-fir type have been so severely defoliated for the past 3 to 4 years that top-killing and whole-tree mortality are now prevalent. In this area of severe defoliation, up to 78 percent top-killing and losses as great as 2.4 cords per acre have occurred. Defoliation in the spruce-fir stands to the south of the main infestation area remained light.

DDT was applied from the air during June to about 24,000 acres of infested spruce-fir type in the Superior National Forest. Here several recreational areas were sprayed by helicopter to minimize spray drift over lakes and streams. Egg counts, made after spraying, indicated an influx of gravid female moths in the periphery of some of the sprayed blocks. However, control on all areas was very good and none will need to be resprayed in 1961.

JACK-PINE BUDWORM, *Choristoneura pinus* Free. Populations of the jack-pine budworm increased greatly in stands of jack pine in several areas in Minnesota and Michigan, and heavy defoliation also was noted on extensive acreages in Wisconsin. In Minnesota, defoliation was severe on some 15,000 acres on the Chippewa National Forest. In Michigan, it was severe on 2,500 acres of the Ottawa National Forest and 4,900 acres of the Upper Michigan National Forest. Mature jack pines are being harvested wherever feasible to reduce the hazard from this budworm.

SARATOGA SPITTLEBUG, *Aphrophora saratogensis* (Fitch). Conditions during 1960 were favorable for high nymphal populations of the Saratoga spittlebug, and potential damage by adults was severe in red pine plantations at several locations in Wisconsin and Upper Michigan. Damage was averted by spraying some 2,600 acres on the national forests in Wisconsin and Michigan with DDT. Approximately 1,600 acres of State and private lands in Wisconsin also were treated. Control may be needed in 1961 on about 3,400 acres in Wisconsin and Michigan.

PINE SAWFLIES. Defoliation of pines by various species of sawflies was reported in all three Lake States. The red-headed pine sawfly, *Neodiprion lecontei* (Fitch), caused the most damage. An outbreak by this species on 3,500 acres of red and jack pine plantations in the northwestern part of Michigan's Lower Peninsula was sprayed with DDT. About 88 acres of red pine were also sprayed on the Rapid River District of the Upper Michigan National Forest. Another heavy infestation on about 40 acres of red pines on the Hayward District of the Chequamegon National Forest was suppressed by applying DDT from knapsack sprayers.

The introduced pine sawfly, *Diprion similis* (Htg.), caused heavy defoliation of white pines and jack pines in various areas in north central Minnesota and northwestern Wisconsin. Red pines and Scotch pines were also attacked to a lesser degree. Defoliation appeared most severe on open-growing trees. The pest was reported for the first time from Marathon and Lincoln Counties, Wisconsin, where windbreaks were stripped.

A large white pine in north central Minnesota completely defoliated by the introduced pine sawfly, *Diprion similis* (Htg.).

WHITE-PINE WEEVIL, *Pissodes strobi* (Peck). Damage by the white-pine weevil was recorded throughout pine and spruce stands in the Lake States. From 30 to 50 percent of the trees in many white pine and jack pine stands were infested, and damage to red pines was also quite common. The Michigan Department of Conservation hand-sprayed DDT on 300 acres of jack pine with good results. Scattered small acreages also were sprayed by hand in Wisconsin.

EUROPEAN PINE SHOOT MOTH, *Rhyacionia buoliana* (Schiff.). Populations of the European pine shoot moth remained essentially unchanged from prior years in pine plantations in Michigan and Wisconsin. An increase in severity of infestation was detected, however, in the western part of Lower Michigan, where winter temperatures were moderated by Lake Michigan. This was offset by a decline in abundance farther inland where unusually cold weather caused high overwintering losses. The southern half of the Lower Michigan Peninsula contained moderate to heavy populations. The northern half of the Peninsula was lightly infested. Populations were higher than in 1959 in Manitowoc County, Wis. Control tests with malathion on the Lower Michigan National Forest did not give satisfactory results.

PINE TIP MOTH, *Rhyacionia adana* Heinrich. This tip moth has only recently been found on young red and jack pines in Michigan. Normally it confines its attack to trees under 2 feet in height. By boring into the terminals of the host trees, the larvae kill the new shoots, causing stunting and deformation. This insect could become a serious nursery pest and could easily be transported throughout the region on infested nursery stock. Damage similar to that caused by this tip moth has also been found in Wisconsin, but positive identification of the insect has not been made.

LARCH SAWFLY, *Pristiphora erichsonii* (Htg.). Defoliation by the larch sawfly was moderate to severe throughout most of the tamarack stands in the Lake States. In northern Minnesota complete stripping was more spotty than noted previously. Farther south, noticeable defoliation was reported as far as central Pine County. In west central Wisconsin, top-killing was evident in many of the defoliated stands.

BLACK PINE LEAF SCALE, *Aspidiotus californicus* Coleman. Approximately 2,000 acres of jack pine in Polk County, Wis., were heavily infested by the black pine leaf scale. Some tree mortality is likely in at least two plantations about 20 years of age.

ZIMMERMAN PINE MOTH, *Dioryctria zimmermani* (Grote). This moth, and its close relative, *D. cambiicola* (Dyar), have caused extensive damage to red pines of all ages on parts of the Cutfoot Sioux Experimental Forest near Cass Lake, Minn. Larvae were frequently found in galls of the pine-oak rust, *Cronartium cerebrum*. The Zimmerman

pine moth was also found in nearly every jack pine stand examined in Michigan.

PITCH NODULE MAKER, *Petrova albicapitana* (Busck). This insect is not normally considered an important forest pest, but a severe outbreak has reduced over 3,000 acres of jack pine in Michigan's Upper Peninsula to a noncommercial stand. The infested area appears to be increasing.

GYPSY MOTH, *Porthetria dispar* (L.). The Michigan Department of Agriculture reported the status of the gypsy moth in Michigan as follows: "Approximately 1,152,000 acres were trapped utilizing 5,000 traps placed approximately 2 per square mile. For the second year no moths were trapped and, of course, a spray program will not be necessary for the spring of 1961. Our previous negative year was in 1958, and if 1961 proves to show negative results, we, of course, will be able to discontinue this program in the anticipation that this particular pest has been eradicated."

FOREST TENT CATERPILLAR, *Malacosoma disstria* Hbn. Populations of the forest tent caterpillar were the lowest on record in the Lake States in several years. Egg band surveys in northern Wisconsin aspen stands revealed no new egg bands. Very few moths were collected from light traps in numerous locations in Minnesota. Very light populations are predicted for 1961.

CENTRAL STATES

by

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Conditions in Brief

A number of miscellaneous insects were abundant in the forested areas in the Central States. Oaks and other hardwoods were severely defoliated on approximately 100,000 acres in south-central Kentucky. Pine weevils were a problem in some Christmas tree plantations in Ohio. A leaf-mining weevil was destructive to yellow-poplar in the vicinity of Crab Orchard, Ky., and light infestations occurred in larger areas in the central and south-central part of the State.

A pine bud miner was discovered in a 4-year-old planting of Scotch pine in Lake County, Ohio, and a *Pissodes-Pullularia* canker complex was suspected of being the cause of severe dieback in young white pines nearby. Dutch elm disease, transmitted by the smaller European elm bark beetle, killed thousands of elms in northern Ohio.

Control of forest insects in the Central States was limited primarily to the spraying of virus organisms on introduced pine sawfly infestations in a few plantations in Ohio. Elm trees were sprayed in many communities in Ohio to reduce feeding by the elm bark beetles and thus reduce the incidence of Dutch elm disease.

Status of Insects

HARDWOOD DEFOLIATORS. Extensive defoliation of oaks and other hardwood species was observed in south-central Kentucky in June. Damage to red oak was particularly heavy in Wayne County, with several stands of 1,000 acres or more being completely stripped. The total area of defoliation throughout Wayne and adjacent counties exceeded 100,000 acres.

Inspections in mid-June were too late for an accurate determination of the leaf feeders involved. However, damage resembling that caused by a leaf roller was common on all hardwood species in the heavy feeding areas. Indications are that two or more species of loopers caused most of the damage. Identified species of insects collected from the Kentucky defoliated areas were the buck moth, *Hemileuca maia* (Drury); a cutworm, *Morrisonia confusa*; the elm spanworm, *Ennomos subsignarius* (Hbn.); and a sphingid, *Deidamia inscriptum* (Harr.).

LEAF MINING WEEVIL, *Prionomerus calceatus* (Say). Heavy damage was caused by this weevil to the foliage of yellow-poplar in a 70-acre tract of saw timber at Crab Orchard, Ky. Evidence of light feeding was also found on poplars throughout the south-central part of Kentucky and south-central Ohio. Rearing records from field collections indicated that parasitism exceeded 50 percent. Six species of parasites emerged from pupae.

SMALLER EUROPEAN ELM BARK BEETLE, *Scolytus multistriatus* (Marsh.). The smaller European elm bark beetle continued at saturation point throughout northern Ohio. Hundreds of thousands of elms have died annually in this area for several years from Dutch elm disease and elm phloem necrosis. It is difficult to find a dead elm in Ohio that has not served as breeding material for this beetle.

PINE WEEVILS, *Hylobius pales* (Hbst.), and *Pissodes* sp. (probably *approximatus*). Pine weevils continue to be a problem in Ohio Christmas tree plantations where pine is cut and replanted within a year. Weevil damage occurred in most plantations in the eastern part of the State. Loss of year-old plantings in some instances has reached 100 percent where replanting followed cutting soon after harvesting. Heavy feeding, particularly by *Pissodes* sp., is producing unsightly pitching and, in some instances, has materially reduced the value of Christmas trees.

Spraying for weevil control has been practiced by some of the larger producers of Christmas trees. 1 gallon of BHC in

10 gallons of kerosene was used to drench stumps and a 2 percent aldrin emulsion spray was used for fall treatments to protect the young plants.

INSECT-CANKER COMPLEX ON WHITE PINE. An insect-canker complex on white pine was reported from Lake County, Ohio, during the early spring of 1960. Two plantations, one of 5 acres and a second of approximately 20 acres of 8-year-old trees were affected. Damage ranged from terminal dieback to complete kill on an estimated 50 percent of the stand.

Entomologists and pathologists are exploring the disease-insect problem. The causal organism has been identified as *Pullularia pullulans*. This is believed to be the first report of the disease *affecting eastern white pine* in the United States.

Heavy feeding by a pine weevil, tentatively identified as *Pissodes approximatus* Hopk., was found consistently near the cankered areas. The damage occurred on the terminal immediately below the first whorl and progressed downward, affecting one whorl on the main stem annually. Weevil infestation of the stem above the canker was found in the affected trees, with heavy emergence of adults taking place in mid-August.

Insect-canker complex on eastern white pine. Note feeding punctures and pitching caused by *Pissodes* sp.

PINE BUD MINER, *Exoteleia* sp. A pine bud miner, probably *Exoteleia* sp., was discovered in a 4-year-old stand of Scotch pine in Lake County, Ohio. The damage was heavy in the 30-acre stand. Inspections in midsummer indicated that the miner had affected approximately 10 percent of the stand, with an average of two infested shoots per tree. Reports from various sources indicated that the miner occurred in several counties in northeastern Ohio, including Geauga and Summit.

WHITE-PINE SHOOT MOTH, *Eucosma gloriola* Heinr. Damage caused by this moth was common in 1960 on Scotch pine and white pine in eastern Ohio. Heaviest damage was observed in Tuscarawas County in a 100-acre stand of 7-year-old Scotch pine. Damage was also observed in other counties in northeastern Ohio. So far, Christmas tree growers do not consider it a serious pest since most of the damage can be removed while shearing for the Christmas market.

INTRODUCED PINE SAWFLY, *Diprion similis* (Htg.). This sawfly was observed feeding on white pine during late summer and early fall in Lake County, Ohio. Infestations and damage were light. Infestations probably extend into the northeastern counties of the State.

VIRGINIA PINE SAWFLY, *Neodiprion pratti pratti* (Dyar). Two small infestations of the Virginia pine sawfly were reported on shortleaf pine near Athens, Ohio. They occurred in an area containing approximately 8,000 acres of shortleaf pine and may become a more serious problem in future years.

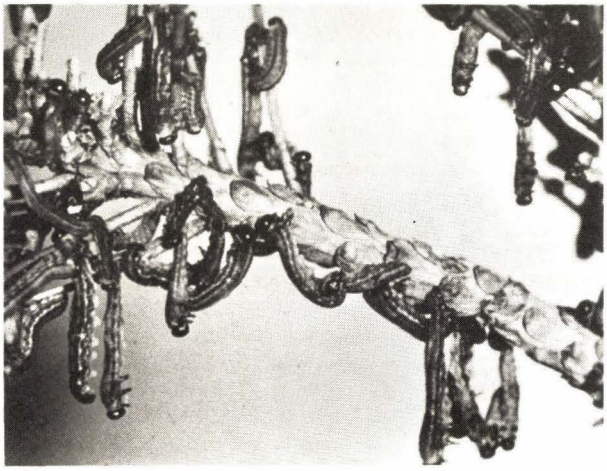
WHITE-PINE SAWFLY, *Neodiprion pinetum* (Norton). This sawfly was found in small numbers in most white pine plantations in eastern Ohio. Most of the infestations were limited to an acre or less; however, one infestation in Guernsey County consisted of approximately 35 acres. Damage was light.

RED-HEADED PINE SAWFLY, *Neodiprion lecontei* (Fitch). The red-headed pine sawfly, which has been an occasional pest on pine in the New Philadelphia, Ohio, area for several years, reappeared in the late fall of 1960 on 700 acres of pitch pine in the Muskingum watershed. Examination in late August showed that an average of 8

percent of the trees in several plantations were infested, with defoliation ranging from 5 to 50 percent. A few small trees were completely defoliated, some of which died. Approximately 2,000 acres of pine, mostly pitch, have been planted in the area during the past 10 to 15 years and are subject to attack.

LOBLOLLY-PINE SAWFLY, *Neodiprion taedae linearis* Ross. Infestations of the loblolly-pine sawfly were light and scattered on shortleaf pine throughout the southeastern part of Missouri. While a few trees were completely defoliated in the Poplar Bluff area, feeding in most areas was extremely light.

EUROPEAN PINE SAWFLY, *Neodiprion sertifer* (Geoff.). Light to moderate infestations of the European pine sawfly were reported on red and Scotch pine throughout most of Ohio. The heavier concentrations occurred in the central and eastern part of the State. Infestations were also reported on Austrian pine in the following counties of Iowa: Lucas, Monroe, Jefferson, and Van Buren. This insect has been a problem for a number of years in northeastern Indiana. Some of the larger landowners have used a polyhedral virus for control and virus treatments have been very effective when properly timed and applied. Plantations in Ohio treated with virus in 1955 continue to remain free of sawfly damage.



Colony of the European pine sawfly affected with a polyhedral virus as a result of treatments made 12 days previously. Total mortality of colony usually occurs within 24 hours after initial larval mortality.

Total mortality of colony of European pine sawfly achieved by spraying with a polyhedral virus.

SOUTHERN STATES

by

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Conditions in Brief

Bark beetles and defoliators were the principal insects affecting forest areas in the Southern States. An outbreak of the southern pine beetle which occurred in the pine stands of southeast Texas in early summer was reduced to a low level by direct control and natural factors by late fall. The black turpentine beetle was destructive throughout the year in many pine stands, particularly those disturbed by logging. Infestations of ips beetles were restricted to overdense pine stands and trees on poor sites or the edges of burns. Sawflies were abundant in pine forests in parts of Louisiana and east Texas. Extensive stands of water tupelo, blackgum, sweetgum, and other bottom-land hardwoods in Louisiana and Alabama were heavily attacked by the forest tent caterpillar.

Status of Insects

SOUTHERN PINE BEETLE, *Dendroctonus frontalis* Zimmerman. Areas infested by the southern pine beetle were less abundant in the Southern States than in the past several years. The amount of timber killed, however, was probably greater. In an outbreak in southeast Texas, beetle populations reached a peak in early summer but were reduced to a low level by direct control and natural factors by late fall. In approximately 500 spot infestations in Hardin and Liberty Counties, trees containing an estimated 10 million board feet of sawtimber and 30 thousand cords of pulpwood were killed. Aggressive, cooperative control by Federal, State, and private agencies prevented losses from being much greater. Investigations in the outbreak area during the fall indicated that infestations in some places were active enough to provide a source of future spread.

Elsewhere in the Southern States, no unusual activity of the southern pine beetle was reported. In Alabama, occasional small spot kills appeared in stands that were overdense or on poor sites. In most instances the beetles were quickly suppressed.

BLACK TURPENTINE BEETLE, *Dendroctonus terebrans* (Olivier). The black turpentine beetle continued active in stumps and trees on most of the national forests and on many industrial ownerships, Southwide. Tree-killing was excessive only in local areas. In the aggregate losses were severe.

On the extensive low sites in parts of the Gulf States, pines are typically shallow rooted and thus are often quickly and strongly affected by extremes in soil moisture. The roots are also highly susceptible to injury by logging machinery; thus damage is particularly severe in stands disturbed successively by the removal of pine poles, sawtimber, and pulpwood, and finally, of hardwoods, each in a separate operation.

Infestations of black turpentine beetle are expected to continue in logging areas, with future trends depending largely upon the volume of timber cut on low, poorly drained sites; on the extent of logging damage and stand disturbance; and on soil-moisture relationships and other factors affecting stand vigor.

IPS (PINE ENGRAVERS), *Ips* spp. Despite late winter ice damage in northern Louisiana and southern Arkansas, and a severe summer drought in parts of Louisiana and Mississippi, ips beetles did not approach outbreak proportions. Infestations were mostly localized, being restricted to overdense stands and trees on poor sites or the edge of burns.

Ips beetles were often associated with southern pine beetle activity in east Texas and Alabama. In Alabama, it was difficult to determine which was primary. Here, *Ips avulsus* Eichh. often first infested the crowns, thus weakening trees enough to bring on attacks by the southern pine beetle, which apparently then reproduced in the lower stems in sufficient numbers

Typical S-shaped tunnels of the southern pine beetle *(Dendroctonus frontalis* Zimm.) on the inner bark of southern pine.

to invade adjacent trees. In these infestations *I. avulsus,* and sometimes other species, assumed a secondary role.

PINE SAWFLIES, *Neodiprion* spp. The red-headed pine sawfly, *Neodiprion lecontei* (Fitch), reappeared near DeRidder, La., in the late spring in such numbers that one landowner suppressed the infestation only after spraying nearly 3,000 acres of young longleaf and slash pine plantations with DDT. About 1,800 acres were treated by aircraft and the remainder by ground equipment. No unusual defoliation by this species was reported in other Southern States.

Infestations of *N. excitans* Roh. were widespread but spotty on industrial lands in southern Polk County and western Hardin

County of east Texas. Larval activity, which was first noticed in late July, stopped by September when the insects spun cocoons in the soil. There was some evidence of egg-laying in the crowns of loblolly pine, but a heavy late-season population failed to materialize.

The loblolly-pine sawfly, *N. taedae linearis* Ross, was again scarce. In some other years it has been a common spring defoliator in northern Louisiana and southern Arkansas.

An unknown species of sawfly severely defoliated young slash pines in two localized areas to the east and west of Gulfport, Miss., in the fall. Larvae spun cocoons in the duff during late November and early December. The extent of the infestations is being determined.

NANTUCKET PINE MOTH, *Rhyacionia frustrana* (Comstock). This moth killed tips and retarded growth in young loblolly and shortleaf pine plantations throughout the South. In some States, it has attracted more attention and comment than any other forest insect.

TEXAS LEAF-CUTTING ANT, *Atta texana* (Buckley). The Texas leaf-cutting ant destroyed many new pine seedlings throughout its range in east Texas and west-central Louisiana.

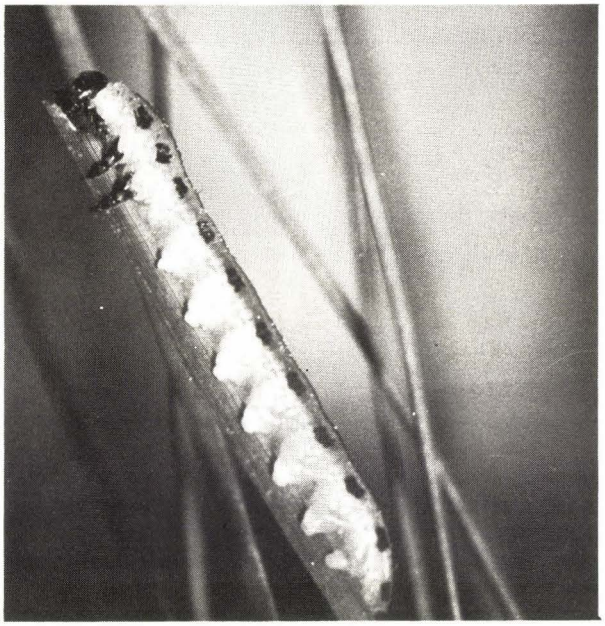
FOREST TENT CATERPILLAR, *Malacosoma disstria* Hubner. This tent caterpillar severely defoliated water tupelo, blackgum, sweetgum, and other bottom-land hardwoods in extensive areas in Louisiana and Alabama during April and May.

In Louisiana, areas immediately west of New Orleans and along the Atchafalaya Basin, about 500,000 acres, were completely defoliated. An additional million acres in localized areas had some defoliation. These smaller areas were prevalent in bottom lands surrounding areas of severe defoliation and in river bottoms to and across the Sabine River, where hardwoods other than gums make up a major portion of the stands.

In the Alabama River Valley, where an outbreak has been underway since 1953, the total area of infestations was estimated at more than a million acres, on 56,000 of which defoliation was heavy. In some areas many trees have died and others have dead branches in their tops. Defoliated trees are growing at less than half their normal rate. The lack of reproduction resulting from the destruction of flowers by defoliation is also causing concern.

Natural controls, including parasitic insects and disease organisms, failed to reduce populations to endemic levels. Preliminary egg surveys indicate that extensive and severe defoliation will occur again in the spring of 1961.

MISCELLANEOUS DEFOLIATORS. The spiny oakworm, *Anisota stigma* (Fab.)., the orange-striped oakworm, *A. senatoria* (J.E. Smith), the yellow-necked caterpillar, *Datana ministra* (Drury), and the variable oak leaf caterpillar, *Heterocampa manteo* (Dbldy.), stripped oaks on thousands of acres in localized areas in Arkansas, Texas, and Louisiana during the late summer and fall. Inasmuch as defoliation occurred late in the season, severe damage to affected trees is not expected.



Top left, full-grown larva of the sawfly *Neodiprion excitans* Roh. in feeding position. Top right, female sawfly, *Neodiprion excitans* in position to oviposit in needle of loblolly pine. Bottom, hundreds of acres of slash pines in southern Mississippi were defoliated in the fall by an undetermined sawfly.

SOUTHEAST

by

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Conditions in Brief

The status of forest insects in the Southeastern States in 1960 was little changed from conditions existing in 1959. Defoliation of hardwoods by the elm spanworm in Georgia, Tennessee, and North Carolina encompassed a gross area of 1,670,000 acres with spread of infestation to the north and east of previously affected stands. In the wake of hurricanes in 1959 and 1960, ips beetles were destructive to pine stands in South Carolina and Florida. An epidemic of the balsam woolly aphid persisted in stands of Fraser fir at Mt. Mitchell, N. C. Sawflies caused extensive defoliation of southern pines in North Carolina, Georgia, and Florida. A spider mite epidemic occurred throughout the vast coastal pine area from North Carolina to Florida.

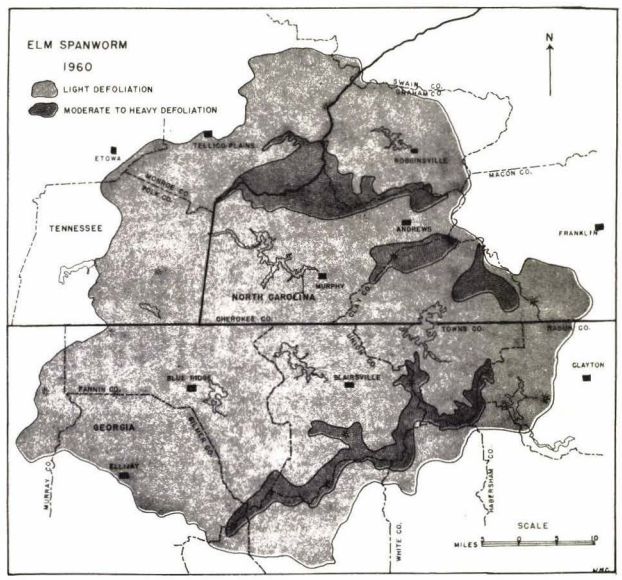
Status of Insects

IPS (PINE ENGRAVERS), *Ips* spp. Hurricanes in 1959 and 1960 were particularly destructive to stands of southern pines in Beaufort and Colleton Counties, S. C., and near Ft. Myers, Fla. In the wake of these hurricanes, ips beetles attacked the uprooted and broken trees. Beetles emerging from these trees attacked and killed many standing trees in South Carolina. Fortunately this did not occur in Florida. Public and private owners of forest lands in affected areas promptly salvaged infested trees, thus averting possible heavier losses.

SOUTHERN PINE BEETLE, *Dendroctonus frontalis* Zimm. Populations of the southern pine beetle were generally low throughout the Southeast. Exceptions occurred on the Pickens District of the Sumter National Forest, S. C.; in coastal pond pine in Dare and Tyrrell Counties, N. C.; and in Accomack and Northampton Counties, Va. Salvage operations were promptly undertaken to control these infestations, but large beetle populations were present in all areas at the close of the year.

BALSAM WOOLLY APHID, *Chermes piceae* (Ratz.). Fraser fir is highly susceptible to attack and damage by the balsam woolly aphid. An infestation, in the scenic area at Mt. Mitchell, N. C., which was discovered only a few years ago, now has killed approximately 6 percent of the host trees in the 22,000-acre area. Control of the aphid is being attempted by the introduction of insect predators from Europe and Australia.

ELM SPANWORM, *Ennomos subsignarius* (Hbn.). An outbreak of the elm spanworm, first observed on small acreages of oaks and hickories in northern Georgia in 1954, encompassed 1,670,000 gross acres in Georgia, Tennessee, and North Carolina in 1960. This is the first reported outbreak of these dimensions by this insect in the Southeast since 1878. Oaks and hickories



Extent of elm spanworm defoliation in Georgia, North Carolina, and Tennessee depicted by shaded areas on map.

Repeated defoliation by the elm spanworm, *Ennomos subsignarius* (Hbn.), is killing oaks and hickories in the southern Appalachian Mountains.

Many pine stands in Virginia, Maryland, and North Carolina were defoliated by the Virginia pine sawfly, *Neodiprion pratti pratti* (Dyar).

growing on ridgetops have been most severely affected. Nearly 200,000 acres of such stands were moderately to severely defoliated. Areas of heavy defoliation spread in 1960 to the north and east into previously uninfested forests. At the same time, defoliation decreased in severity in other areas. An egg survey in September showed this population change to the north and east quite clearly, and expected high populations in 1961 pose a threat to high elevation stands near Franklin, N. C.

FALL CANKERWORM, *Alsophila pometaria* (Harr.). Hardwood forests on approximately 25,000 acres of the Jefferson National Forest, Va., were severely defoliated by the fall cankerworm. In addition, heavy defoliation was reported on the George Washington National Forest, Giles County, Va., and on two small tracts of timber near Hot Springs, N. C.

PINE CHAFER, *Anomalo oblivia* Horn. A pine chafer caused injury to about 2,500 acres of 2- and 3-year-old loblolly pines planted near Bolton, N. C. The damage consisted of defoliation of current season's needles. Establishment of loblolly pine in the Southeast provides an excellent environment for the buildup of pine chafer populations.

PINE SAWFLIES, *Neodiprion* spp. The Virginia pine sawfly, *N. pratti pratti* (Dyar), caused extensive defoliation during the year. In Virginia and North Carolina noticeable defoliation occurred on 2,000,000 gross acres. This was the fifth year defoliation has occurred in Virginia and the third in North Carolina. Thus far, infestations have not caused tree mortality.

Neodiprion excitans Roh. defoliated shortleaf pines on about 600 acres in Paulding County, Ga. On the basis of examinations of cocoons in the infestation sites, it is believed that the population is decreasing. A 300,000-acre epidemic of this sawfly occurred in Florida in 1958. It declined in 1959 and dropped to endemic numbers in 1960.

An infestation of *Neodiprion virginicus* complex on slash pine near Statesboro, Ga., in 1959, was materially reduced by natural factors in 1960.

SPIDER MITE, *Oligonychus milleri* (McG.). A spider mite occurred in outbreak numbers in pine stands over the vast coastal area

from North Carolina into Florida. Adults were numerous in June. Extensive outbreaks of this mite on pine have been reported previously in the Southern States. Causes of the outbreaks and their decline are not known.

NANTUCKET PINE MOTH, *Rhyacionia frustrana* (Comst.). Surveys were not made in the Southeast during 1960 for this ever-present and widely distributed enemy of young pines. It was common, however, through the growing season in all Southern States and from three to six generations were produced.

SCALES. An unidentified *Toumeyella* scale was reported to be troublesome on loblolly pine seedlings near Spindale, N. C. It was also damaging to slash pine seedlings experimentally exposed to long day conditions at Olustee, Fla. The black pine leaf scale, *Aspidiotus californicus* Coleman, caused yellowing of shortleaf pine foliage at Jamestown, Tenn.

NORTHEASTERN STATES

by

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Conditions in Brief

There were numerous, localized outbreaks of several destructive forest insects in the Northeastern States in 1960. Gypsy moth infestations increased in several localities and remained at high levels generally. Many of the hardwood defoliators, including leaf feeders, miners, rollers, and webmakers were abundant. Sawfly infestations were serious in some areas, and defoliation they caused of red pine in New York and of pitch pine in Massachusetts and New Jersey was noteworthy. Tent caterpillars continued to damage hardwood stands in the centers of the outbreaks of the past 3 years, but their numbers declined markedly. The spruce budworm epidemic in Maine was controlled by spraying on 217,000 acres. Favorable budworm development and low parasitism, however, indicate the need for spraying approximately 45,000 acres in 1961.

Status of Insects

SPRUCE BUDWORM, *Choristoneura fumiferana* (Clem.). Medium and heavy spruce budworm populations in stands of balsam fir existed adjacent to and inside part of the 1958 control area centered around Route 11 north of Ashland, Maine. In addition, significant populations appeared to the eastward as a result of moth flight and perhaps larval dispersal. The weather in 1960 was favorable to larval development. Larval and pupal surveys revealed a decrease in aggregate parasitism, a trend which has been discernible over the past 3 years. A total of 217,000 acres was sprayed with DDT mixed in oil at 12 percent and delivered by converted TBM's at the rate of one gallon per acre. Postspray assessment revealed reduction in budworm numbers of 95 percent or better in most blocks. Infestation is expected to be serious enough in approximately 45,000 acres lying in a band on the southern edge of the area sprayed this year to warrant control in 1961.

BALSAM WOOLLY APHID, *Chermes piceae* (Ratz.). This aphid is a serious pest of balsam fir in coastal Maine where gouting of affected trees is widespread. Inland in the Penobscot Experimental Forest, where damage is being caused both by gouting and stem attack, new trees were infested this year and damage symptoms advanced on those already infested.

WHITE-PINE WEEVIL, *Pissodes strobi* (Peck). The white-pine weevil, a perennial pest of white pine in the Northeast, was more destructive than usual in Massachusetts. In New York, damage was severe, with high populations prevailing generally over the whole region.

SAWFLIES, *Neodiprion* and *Diprion* spp. The European pine sawfly, *N. sertifer* (Geoff.), attacked hard pines, notably red pine, in New York and southern Connecticut. Since refoliation of the affected trees was quite rapid, no mortality was observed. A pathogenic fungus obtained from the eggs of *N. pini-rigidae* (Nort.) is being tested in New Jersey against the European pine sawfly. Small-scale virus applications were made in Niagara, Herkimer, and Dutchess Counties, New York.

Neodiprion pratti paradoxicus defoliated pitch pine extensively in Plymouth County, Massachusetts, and in New Jersey south of Trenton. The New Jersey infestation is declining but is accompanied by an increasing infestation of *N. pini-rigidae* (Nort.). The factors causing mortality are unknown except that the latter sawfly apparently has two generations a year which could allow it to develop out of synchrony with agents acting to suppress *N. pratti paradoxicus*.

The red-headed pine sawfly, *Neodiprion lecontei* (Fitch), caused considerable damage to red and Scotch pines in certain localities in New York and some tree mortality was observed. The red-pine sawfly, *N. nanulus nanulus* Schedl, defoliated pitch pine in Plymouth, Mass.; and the introduced pine sawfly, *Diprion similis* (Htg.), defoliated white

and red pines in central Connecticut and eastern Massachusetts.

The balsam-fir sawfly, *N. abietis* (Harr.), was scattered and light in Maine. The European spruce sawfly, *Diprion hercyniae* (Htg.), and the yellow-headed spruce sawfly, *Pikonema alaskensis* (Roh.), were both common in Maine.

EUROPEAN PINE SHOOT MOTH, *Rhyacionia buoliana* (Schiff.). The European pine shoot moth was again a serious depredator of red and Scotch pines in the Northeast. It was especially severe in parts of Pennsylvania and the northern panhandle of West Virginia. The shoot moth is becoming a more serious pest in coastal Maine from Freeport to Newcastle and on Bailey Island.

NANTUCKET PINE MOTH, *Rhyacionia frustrana* (Comst.). The Nantucket pine moth damaged Scotch pine heavily in New Castle County, Del. Seedlings in a soil-bank planting in Maryland were 90 percent infested.

PINE LEAF APHID, *Pineus pinifoliae* (Fitch). White pine in Maine was severely damaged by this aphid. In that State, the seriously infested area is between Lincoln and Topsfield and southward to the sea. Less extensive but locally severe infestations occurred in the upper Connecticut River valley, in Vermont and New Hampshire. Effects of the current infestation, which dates from about 1957, seem to be more apparent than in prior years--whether from the real cumulative effects of attack or from an increased awareness of the problem, one cannot say.

RED-PINE SCALE, *Matusucoccus resinosae* B. & G. The red pine scale was discovered in New Jersey for the first time--in 160 acres of watershed planting around the Wanague Reservoir in the north central part of the State. Complete removal of trees in the infested area is planned.

WHITE-PINE CONE BEETLE, *Conophthorus coniperda* (Sch.). This beetle was quite abundant throughout New England. Its toll on the seed crop was very high.

FOREST TENT CATERPILLAR, *Malacosoma disstria* Hbn. The forest tent caterpillar remained in outbreak status in hardwood forests in Maryland, Pennsylvania, and New York. Heavy feeding occurred in Carroll, Washington, and Frederick Counties, Md.; but the extent of feeding was reduced there as well as in West Virginia. Heavy feeding occurred in Cumberland County, Pa., and light feeding in Dutchess and Columbia Counties, N. Y. Over 5,000 acres of oak and other hardwoods were 90 to 100 percent defoliated in one New York locality. The parasitic fly, *Sarcophaga aldrichi*, seen in abundance following these outbreaks, and virus and bacterial diseases were extremely influential in helping to reduce the population trend.

EASTERN TENT CATERPILLAR, *Malacosoma americanum* (F.). This defoliator was abundant in New York, Pennsylvania, and West Virginia.

GYPSY MOTH, *Porthetria dispar* (L.). Continued efforts to control the gypsy moth were made by State agencies and the Plant Pest Control Division, ARS. The control efforts of New York State covered 11,000 acres in Saratoga, Schenectady, Albany, Montgomery, Washington, Warren, and Essex Counties. The New York State Conservation Department and the U. S. Department of Agriculture sprayed another 8,000 acres in Delaware, Otsego, Herkimer, and Oneida Counties, using Sevin in oil suspension.

Approximately 1,800 acres of infestation were sprayed in Massachusetts during May, and in May and early June approximately 20,000 acres were sprayed in Connecticut. A total of 2,400 acres were sprayed in New Jersey.

A total of some 50,000 acres of defoliation in the area of infestation were mapped by aerial surveys. This represents an increase over last year.

Defoliation in the various Northeastern States was reported as follows:

	Acres
Maine	6,000
New Hampshire	4,500
Vermont	6,000
Connecticut	15,000
Massachusetts	150
New York	16,500

About 4,000 acres in New York were 75 to 100 percent defoliated. An estimated 7,500 to 10,000 acres will require treatment next year in Massachusetts.

MISCELLANEOUS DEFOLIATORS. The oak leaf-roller, *Argyrotoxa semipurpurana* (Kerf.), caused severe defoliation over extensive areas in southwestern Massachusetts,

northwestern Connecticut, and New York. Black, red, scarlet, and pin oaks were attacked.

The orange-striped oakworm, *Anisota senatoria* (J. E. Smith), and the red-humped oak worm, *Symmerista albifrons* (J. E. Smith), were locally abundant in Connecticut and New York. The elm leaf beetle, *Galerucella xanthomelaena* Müller, severely damaged elms in central and southern Maine. It was also noticeably destructive statewide in Pennsylvania. The fall webworm, *Hyphantria cunea* (Drury), was prominent in the Northeast coincident with its general abnormal abundance all over the eastern United States. Fall and spring cankerworms, *Alsophila pometaria* Harr., and *Paleacrita vernata* (Peck), defoliated large areas in Connecticut and Pennsylvania.

The birch leaf miner, *Fenusa pusilla* (Lep.), was common in Maine and New Hampshire. Infestations of the solitary and gregarious oak leaf miners, *Cameraria hamadryadella* (Clem.), and *C. cincinnatiella* (Chamb.), were widespread in the Northeast. Other common leaf miners and skeletonizers were the locust leaf miner, *Xenochalepus dorsalis* (Thun.), the oak skeletonizer, *Bucculatrix ainsliella* Murt., and the birch skeletonizer, *B. canadensisella* Chamb.

The beech scale, *Cryptococcus fagi* (Baer.), was found farther north than ever before in New York--in Arietta, Hamilton County. The Asiatic oak weevil, *Cyrtepistomus castaneus* (Roelofs), increased markedly in numbers in southern West Virginia. It was also found statewide in Pennsylvania, and in Allegany and Washington Counties, Md.

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